Computer Graphics
(600.457/657)

Prof. Misha Kazhdan
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Outline

• Introduction
• Syllabus
• Coursework
• Miscellaneous
Introduction: What is CG?

- 2D image processing
- 3D object representation & manipulation
- Simulating physical processes & materials
- Animating any of the above
Introduction: What is CG?

2D image processing

- 3D object representation & manipulation
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Introduction: What is CG?

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“Incredibles 2” Disney / Pixar
Introduction: What is CG?

- 2D image processing
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- Animating any of the above

Gringold et al. 2004
Introduction: What is CG?

• 2D image processing
• 3D object representation & manipulation
• Simulating physical processes & materials

Animating any of the above (4D)

Team Fortress 2: Meet the Heavy, Valve
Introduction: What is CG?

“You know it when you see it…”

http://www.creativecrash.com/tutorials/
Introduction: What is CG?

“You know it when you see it… maybe.”

http://www.creativecrash.com/tutorials/
Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization
- Training & Education
Introduction: Applications

Entertainment

• Computer Aided Design
• Scientific Visualization
• Training & Education

“How to Train Your Dragon 2”
DreamWorks

“Gears of War 4”
The Coalition
Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization
- Training & Education

Completely virtual model built in 3D:
- Shorten the development period
- Shorten the learning curve
Introduction: Applications

- Entertainment
- Computer Aided Design
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Neutron Star Collision
Courtesy of David Bock

Aspirin in RasMol
Courtesy of Michael Friendly

The Visible Human
Courtesy of NLM

Flow Visualization
Roettger et al.
Introduction: Applications

- Entertainment
- Computer Aided Design
- Scientific Visualization

Training & Education

Image courtesy of Agrawala et al.
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Syllabus

- Image Processing (2D)
- Ray Tracing (3D)
- Rendering (3D)
- Modeling (3D)
- Animation (4D)
Syllabus

• Image Processing
  ◦ Quantization and Dithering
  ◦ Sampling
  ◦ Filters
  ◦ Warping, Morphing, and Compositing
Syllabus

• Ray Tracing
  ◦ Cameras
  ◦ Primitives
  ◦ Lights
  ◦ Spatial Data Structures
  ◦ Reflection, Transparency and Refraction

• Rendering
  ◦ Coordinate Systems and Modeling Transformations
  ◦ Viewing transformations
  ◦ Shading
  ◦ Textures
  ◦ Visibility
  ◦ OpenGL
Syllabus

• Modeling
  ◦ Triangles
  ◦ Splines
  ◦ Subdivision Surfaces
  ◦ Procedural Models
  ◦ Point Based Models

• Animation
  ◦ Key-Framing
  ◦ Kinematics
  ◦ Dynamics
Outline

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Coursework

• NB: Lots of work!
• Exams (30%)
• Programming assignments (60%)
• Class participation (10%)
Coursework

• NB: Lots of work!

Exams (30%)
  ◦ Two exams
  ◦ Absolutely no excuses will be accepted for missing the exams. Not taking the exam at the scheduled time = 0!

• Programming assignments (60%)

• Class participation (10%)
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)
  ◦ Image Processing (15%)
  ◦ Ray Tracing (15%)
  ◦ OpenGL Rendering (15%)
  ◦ Animation (15%)

• Class participation (10%)
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)
  ○ Knowledge of C/C++ assumed!
  ○ Must be turned in by 23:59 on due date
  ○ 5 late days (combined)
  ○ Notify TA in your readme if you use a late day
  ○ Otherwise, late assignments receive NO credit

• Class participation (10%)
Coursework: Collaboration Policy

• You must write your own code
• You must reference sources of ideas/code

It’s okay to:
  ◦ Discuss ideas with other students
  ◦ Get ideas from books, web sites, etc.
  ◦ Get “support code” from books, web, etc.
    » REFERENCE IT

It is not okay to:
  ◦ Share code with other students
  ◦ Copy code from other students
  ◦ Use ideas or code from other sources without attribution
Coursework

• NB: Lots of work!

• Exams (30%)

Programming assignments (60%)

• Class participation (10%)

Bottom line:
If you don’t LOVE programming, don’t take this class!
Coursework

• NB: Lots of work!
• Exams (30%)
• Programming assignments (60%)

Class participation (10%)
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Miscellaneous

• Course web page:
  ◦ http://www.cs.jhu.edu/~misha/Fall18

• Piazza page:
  ◦ http://piazza.com/jhu/fall2018/600457657

• No required text book.
  ◦ Additional reading:
    » *Computer Graphics: Principles and Practice in C*
      Foley, van Dam, Feiner, and Hughes
    » *Computer Graphics, C Version*
      Hearn and Baker
    » *OpenGL Programming Guide: The Official Guide to Learning OpenGL*
      Neider, Davis, and Woo
    » *Fundamentals of Computer Graphics*
      Shirley

• Will **not** cover GPU programming (e.g. shaders)
Miscellaneous

• Teaching/Course Assistants:
  ◦ Sing Chun Lee
  ◦ Steve Zhao

• Office hours:
  ◦ Mine: Monday 2:00 – 3:00 @ Malone 229
  ◦ Sing Chun’s: TBD
  ◦ Steve’s: TBD

• Keeping in touch:
  ◦ Email: cs457@cs.jhu.edu
  ◦ Note:
    » Do not send code snippets.
    » Do not ask us if your implementation is correct.
Miscellaneous

Assignment 1:
- Image Processing
- Due September 27 @ 11:59 pm
- Even if you won’t start working on the code until later, download it and try compiling ASAP to make sure that things are correctly set up on your system.